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BOOK REVIEW

Applied Spatial Data Analysis with R

By Roger S. Bivand, Edzer J. Pebesma, and Virgilio Gómez-Rubio. 2008. Series: Use R!
New York, NY: Springer. 374 + xiv. ISBN: 978-0-387-78170-9.

I regularly offer a spatial analysis of social data course to graduate students in social sciences. This course covers basic GIS analysis techniques, map making, exploratory spatial data analysis, and spatial regression modeling. In addition to the typical difficulty of teaching a multitude of theories, principles, and methods to a group of students who have no background in spatial data analysis but have a fear of both statistics and software, two other dilemmas arise in teaching this class: to assign a textbook and to select one software package for use throughout the semester.

Most existing spatial data analysis textbooks are written for natural scientists or regional scientists and require that readers have a good understanding of advanced statistics and probability theory. These textbooks are either too technical for social scientists or are focused on only a few methods and exclude others, partly due to the rapid development in the methods. Regarding the selection of software, R seemed the most logical considering its power and increasing popularity. Also there are plenty of books on R (possibly 200+ by the time this review is published). Unfortunately, many social science students fear any coding beyond three lines. In the past, to avoid scaring students off spatial data analysis I had to juggle the ESRI ArcGIS package, GeoDa, and SpaceStat despite the inconvenience of doing so. If I had decided to adopt R for my class an additional important consideration is whether students would have to buy two textbooks; one for the methods and the other for the software and application? As someone who is sympathetic about students paying high costs for textbooks, I am reluctant to take that approach.

During a coffee break I mentioned my dilemmas to a colleague in a statistics department and she recommended *Applied Spatial Data Analysis with R* by Bivand, Pebesma, and Gómez-Rubio (hereafter *ASDA*). I am so glad she did. This book not only covers most of what I teach in my class but also solves my two dilemmas.

The *ASDA* book is composed of two parts. Part I introduces how to use R for handling spatial data, including basic R classes and methods (Chapter 2), spatial data input and output (Chapter 3), spatial data visualization (Chapter 4), spatial analysis methods (Chapter 5), and R programming (Chapter 6). Chapter 2 provides an introduction to R, and Chapters 3–5 cover the must-have components of Introduction to GIS classes. Chapter 6 demonstrates how to customize existing R packages or develop your own R packages for your spatial data analysis needs. Part II introduces how to use R to do spatial statistical analysis, including spatial point data analysis (Chapter 7), geostatistics (Chapter 8), and areal data analysis (Chapters 9–10), and also includes a special topic of disease mapping as an example for areal data analysis (Chapter 11). The three methods as covered in Chapters 7–10 are typical for a spatial statistics book.

ASDA has three strengths, more or less corresponding to the difficulties that I have had in teaching the spatial analysis of social data course. The first strength is that the book provides comprehensive coverage of spatial

analysis and statistics in under 300 pages. In contrast with many existing textbooks, *ASDA* concisely covers the most essential topics of spatial analysis and statistics for use in *applications*. The text is written in a style that is easy-to-follow and readers with little or no background in spatial analysis and statistics should have no difficulty following along.

How could the authors provide such comprehensive coverage of the knowledge without losing sight of the essential topics? Briefly, their comprehensive coverage of each method is concise, and with little jargon. For those in need of additional details, the readers are referenced to the most relevant and an up-to-date publications. This is the second strength of this book.

The third strength, and my personal favorite, is that the authors combine the discussion of methods and R in a seamless manner. For each chapter theme or method, the authors provide a concise introduction and summary of the method, R codes for running the analysis, and the R outputs. That allows readers to exercise the use of R codes for that particular method and to check to make sure they are doing the right thing by comparing to the R outputs provided on the book. Readers could then modify the R codes for their own spatial data analysis.

All of that said, I have two suggestions for the authors to consider within future editions. First, spatial econometric models could be covered in greater detail. In my opinion, social scientists, especially those who need and would appreciate this book the most—spatial demographers—are those who traditionally use standard econometric (or regression) models frequently to study social phenomena at aggregated geographic levels, such as counties, census tracts, and others. Among the three most commonly used spatial data analysis methods, spatial econometrics is the one that most easily builds upon their current modeling practice. *ASDA* addresses spatial econometric models only in one section (Section 10.4), covering only spatial lag and spatial error models. Other spatial econometric models could be covered. I understand that this book might be intended for a wider audience, but it is my spatial demography belief that many readers/instructors would want more coverage on spatial econometric models.

My second suggestion is that *ASDA* include a comparison of R to other software packages, either as a whole or for each individual method. I say this as many of us have used multiple software packages (such as ArcGIS, GeoDa, SpaceStat, and spatial extensions in Stata, SPSS, SAS, and others) for a variety of different spatial analysis purposes. Most would likely prefer to eventually migrate to one platform and as such it would help to know the capacity, advantages, and disadvantages of the available software packages for running each method.

Overall then, if you are someone who wants to learn spatial analysis and statistics quickly (say in a semester or two) and to use these techniques to analyze your data in one software package environment, or if you are an instructor looking for a single textbook on spatial data analysis and R instruction for a class, this would be the book.

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